Division 1:
Prehospital
Environment

Section 7. Airway Management and Ventilation

a. Cords and larynx
b. Esophagus and larynx
c. Epiglottis and larynx
d. Tongue and larynx
e. True cords and false cords
f. Pharynx and larynx

Given a list of arterial oxygen concentrations, the student should be able to select the normal PO_2, for a young adult breathing air.

Given a list of arterial carbon dioxide concentrations, the student should be able to select the normal PCO_2.

7.5 Given an increase in arterial PCO_2, the student should be able to name this condition and describe its effect on respiratory activity and on blood pH in the normal individual.

1.7.6 Given a decrease in arterial PO_2, the student should be able to name this condition and describe its effect on respiratory activity in the normal individual.

Given an increase in CO_2 production, the student should be able to list at least two ways in which this increase may occur.

1.7.8 Given an increase in CO_2 elimination, the student should be able to describe how this elimination can occur.

1 7 9 Given a list of statements, the student should be able to identify the statement that best describes the purpose of suctioning a patient.

1.7.10 Given a diagram of a piston-powered suction unit, the student should be able to label and describe the operation and cleaning of each component and attached part.

.7. Given that there are various types of suction units, the student should be able to list at least four different types of units determined by the method in which the suction effect is obtained.

1.7.12 Given that there are various types of suction catheters, the student should be able to list at least three different types, determined by difference in use and material composition.

Given a list of situations describing patients who require suctioning, the student should indicate which type of catheter should be used.

.7.14 Given a list of statements, the student should be able to identify the statement that best describes the purpose of using the esophageal obturator airway.

1.7.15 Given a list of situations describing patients with airway maintenance problems or potential airway maintenance problems, the student should be able to identify situations in which the use of the esophageal obturator airway is indicated and contraindicated.

.7.16 Given a list of situations, the student should be able to idenitify those situations in which the esophageal airway may be removed.

.7.17 Given a list of advantages, the student should be able to identify the advantages of using the esophageal obturator airway over other methods of airway control.

Given a list of airway adjuncts, advantages, and disadvantages, the student should be able to match the airway adjuncts with the advantages and disadvantages.

S1.7.19 Given an adult manikin, oropharyngeal and nasopharyngeal airways, pocket mask, oxygen cylinder, and bag-valve-mask, the student should be able to demonstrate the procedure for administering intermittent positive pressure ventilation using:

a. Pocket mask

b. Bag-valve-mask and oropharyngeal airway

c. Bag-valve-mask with oxygen

d. Nasopharyngeal airway with bag-valve-mask

S1.7.20 Given a bag-valve mask, the student should be able to demonstrate the assembly, disassembly, and cleaning of the bag-valve-mask unit.

S1.7.21 Given an adult manikin, an oropharyngeal airway, and a demand-valve unit, the student should be able to demonstrate the procedure for performing intermittent positive-pressure ventilation.

S1.7.22 Given a demand-valve unit, the student should be able to demonstrate the assembly, disassembly, and cleaning of the unit.

1.7.23 Given a list of disadvantages, the student should be able to identify the disadvantages of using the esophageal obturator airway over other methods of airway control.

1.7.24 Given a diagram of the esophageal obturator airway, the student should be able to label and describe the function of all component parts.

1.7.25 Given a list of equipment and materials, the student should be able to identify those items that must be available before esophageal obturation is begun.

1.7.26 Given that a patient requires an esophageal obturator airway, the student should be able to list the procedures for insertion of the esophageal airway, including all steps in the proper sequence.

1.7.27 Given a list of errors, the student should be able to identify common errors involved in the use of the esophageal obturator airway.

*1.7.28 Describe laryngoscope, suction, endotracheal tube and bag-valve mask.

*1.7.29 Discuss indications and contraindications of endotracheal intubation.

*1.7.30 Discuss alternatives to endotracheal intubation.

*1.7.31 Discuss skill deterioration and methods of prevention.

*1.7.32 Discuss need for rapid placement of ET tube.

*1.7.33 Discuss methods of assuring and maintaining correct placement of ET tube.

*1.7.34 Given that a patient needs suctioning and already has an endotracheal tube in place, the student should be able to describe the difference between endotracheal suctioning and oropharyngeal suctioning, including:

a. Dangers

b. Precautions

*S1.7.35 Given an adult intubation manikin, an esophageal obturator airway, 30-cc syringe, and a bag-valve unit, the student should be able to demonstrate the technique for the insertion of an esophageal obturator airway. He should further be able to demonstrate endotracheal

intubation with the esophageal obturator in place and subsequent correct removal of the obturator.

*S1.7.36 Demonstrate placement of an ET within 45 seconds.

*S1.7.37 Demonstrate ventilation with bag valve and endotracheal tube.

*S1.7.38 Demonstrate method by assuring and maintaining correct placement of ET tube.

*S1.7.39 Demonstrate reventilation for missed intubation.

*S1.7.40 Demonstrate skills described above both on manikin and a live patient.

* Indicates Optional
(S) Indicates Skill Objective

TOPIC	CONTENT OUTLINE
Introduction	A. Need for oxygenation B. Major prehospital causes of death C. Most neglected of prehospital skills D. Fick Principle (Aerobic Metabolism plus RBC Oxygenation = RBC Delivery)
	Airway Anatomy and Physiology
Anatomy of Upper Airway	A. Nasopharynx 1. Nares 2. Cartilage 3. Nasal bones 4. Maxilla 5. Vascular supply B. Oropharynx 1. Lips 2. Cheeks 3. Tongue 4. Hard palate 5. Soft palate 6. Tonsillar pillows 7. Teeth 8. Vascular supply 9. Mandible 10. Mandible/tongue relationship and association C. Hypopharynx 1. Epiglottis 2. Tongue-epiglottis relationship 3. Posterior pharyngeal wall 4. Lateral pharyngeal wall 5. Anterior pharyngeal wall 6. Pyriform sinus D. Larynx 1. Thyroid cartilage 2. Cricothyroid cartilage 3. Trachea 4. Esophagus 5. Trachea-esophagus relationship 6. Vocal cords 7. Arytenoid folds
Anatomy of Lower Airway	A. Trachea 1. C-shaped, incomplete rings 2. 10–12 centimeters 3. Respiratory epithelium contains ciliated and mucus-producing cells

INSTRUCTOR'S NOTES

4–5 inches long.

TOPIC	CONTENT OUTLINE
	B. Right and left mainstem bronchi 1. Carina 2. Length and position of bronchi C. Secondary bronchi D. Bronchioles E. Respiratory bronchioles F. Alveolar ducts G. Alveolar sacs H. Alveoli 1. Most important functional unit of system 2. O_2, CO_2 exchange occur 3. Hollow, thin-walled 4. Capillary system covers the outer surface via terminal branches of the pulmonary artery I. Lungs 1. Comprised of the respiratory bronchioles and alveoli 2. Position in thoracic cavity 3. Visceral pleura 4. Parietal pleura 5. Pleural space 6. Right lung a. Upper lobe b. Middle lobe c. Lower lobe 7. Left lung a. Upper lobe b. Lower lobe 8. Blood supply a. Pulmonary artery and veins b. Bronchial artery and veins
Mechanics of Respiration/ Ventilation	A. Definition 1. Respiration—exchange of gases between a living organism and its environment 2. Pulmonary ventilation— process that moves air into and out of the lungs B. Respiratory cycle 1. Involves respiratory system, central nervous system, musculoskeletal system 2. Begins from midpoint or position of thorax after a normal expiration; air pressure inside lungs is equal to atmospheric pressure 3. Inspiration a. Initiated by contraction of diaphragm and intercostal muscles b. Flattening of diaphragm toward the abdomen with resulting increase in the vertical dimensions of the thoracic cavity

INSTRUCTOR'S NOTES

Contain only connective tissue

Oxygen and carbon dioxide across membranes.

c. Elevation of the ribs upward and outward to increase the horizontal and transverse dimension of the thoracic cavity
d. The highly elastic lungs assume the contour change resulting in larger lung dimensions
i. The same air volume in the lung occupies a larger space
ii. Air pressure in the lung decreases rapidly
iii. Air flows in through respiratory passage since pressure in the airways is less than atmospheric pressure

4. Expiration
a. Occurs as inspiratory muscles relax
b. Decreasing thoracic volume and increasing intrathoracic pressure
c. Air is thereby forced out of the lungs
d. Normal expiration is a passive process

5. In respiratory inadequacy accessory muscles aid inspiration and expiration
a. Abdominal wall muscles
b. Neck muscles

C. Pulmonary circulation
1. Body cells take oxygen from the blood and return carbon dioxide to the blood
2. The venous system returns oxygen-poor, carbon dioxide-rich blood to the right side of the heart
3. The right ventricle pumps that blood into the pulmonary artery
a. The artery bifurcates into left and right bronchi supplying the respective lungs
b. Both branches rapidly split into smaller vessels and eventually into microscopic pulmonary capillaries that:
i. Spread over the surface of the air sacs, where the blood picks up oxygen
ii. Recombine into sequentially larger vessels forming the pulmonary veins

4. Pulmonary veins empty into the left atrium and then into the left ventricle from which oxygen-rich blood is pumped and circulated through the systemic arterial system

D. Gas exchange in the lungs
1. Process opposite to that normally occurring in the body, i.e., blood returning from the body is low in oxygen, high in carbon dioxide
2. Measurement of oxygen and carbon dioxide
a. Definition
i. Partial pressure describes the amount of gas in a mixture
(a) Sum of all gases present must equal the total gas pressure
(b) Any partial pressure of any one gas is a fractional concentration of the total gas mixture
b. Total gas pressure (sea level) equals atmospheric pressure or 760 mmHg
i. Torr equals 1 mmHg

INSTRUCTOR'S NOTES

Above atmospheric pressure

Arterial system

Venous system

ii. One atmosphere equals 14.7 lb/sq.in.

c. Concentrations

i. Room air contains 21% oxygen and 0.03% carbon dioxide

ii. Breathing room air produces PO_2 (PaO_2) of 140 torr and PCO_2 ($PaCO_2$) close to zero in the alveoli

iii. Venous blood from tissues contains PO_2 of 40 torr and PCO_2 of 46 torr

iv. Room air also contains 79% nitrogen

(a) No metabolic function

(b) Necessary for maintaining inflation of body cavities that are gas filled

d. Diffusion

i. Gases diffuse from areas of higher partial pressure concentrations to areas of lower partial pressure concentrations

ii. Rate of gas diffusion across pulmonary membranes depends on solubility in water

iii. Oxygen diffuses into blood plasma and combines with hemoglobin

(a) Each gram of saturated hemoglobin carries 1.34 ml of O_2

(b) Hemoglobin is close to being fully saturated at PO_2 of 50–100 mHg

(c) Normal arterial PO_2 (sea level) is 80–100 mmHg

e. Carbon dioxide concentrations

i. Carried as:

(a) 66% bicarbonate

(b) 33% combines with hemoglobin

(c) Small amount dissolves in plasma

ii. Arterial PCO_2 35–40 torr

E. Regulation of respiration

1. Voluntary control versus involuntary control

a. Action is mainly involuntary

b. Chemical, physical and nervous reflexes monitor body oxygen needs

2. Respiratory center located in the brain stem

a. Nerve impulses sent to the diaphragm and intercostal muscles

b. Inspiration initiated

3. Microscopic stretch receptors stop inspiration

a. Inspiratory stretching activates the stretch receptors

b. Nerve impulses follow afferent pathways and return to the brain stem

c. Inspiratory act is curtailed, allowing elastic recoil of the lung

d. Stretch receptors of the lung cease to send impulses to the brain stem

INSTRUCTOR'S NOTES

CO_2 is 21 times more soluble in water than O_2

Pneumotaxic center.

Located in the lung and pleura.

e. The cycle begins again with inspiratory impulses originating in the brain stem

4. Regulation by chemoreceptors
   a. Central chemoreceptors located in the medulla: peripheral chemoreceptors located in the aortic arch and carotid bodies
   b. Chemoreceptors are stimulated by increased PO_2, decreased PCO_2 or decreased pH
5. Carbon dioxide concentration in the blood results in a decrease or increase in respiratory activity
   a. High CO_2 concentration increases respiratory activity
   b. Low CO_2 concentration decreases respiratory activity
   c. Hypoxemia is the most profound stimulus to respiration in the normal individual
6. Hypoxic drive
   a. Individuals with chronic respiratory disease have decreased ability to eliminate CO_2 and respiratory centers accommodate to high PCO_2 levels
   b. Respiratory rate and depth respond to PO_2 levels below 60 torr
   c. Dominant control of respiration in these individuals are changes in PO_2

F. Modified forms of respiration
1. Coughing—forceful exhalation of a large volume of air.—serves protective function
2. Sneezing—a sudden forceful exhalation from the nose, usually caused by nasal irritation
3. Hiccup—sudden inspiration caused by spasmodic contraction of the diaphragm.—serves no useful purpose
4. Sighing—slow, deep inspiration followed by prolonged expiration—Hyperinflates lungs re-expanding atelectatic areas

G. Measures of respiratory function
1. Respiratory rate
   a. Normal adults, 10–14 per minute
   b. Infants, 40–60 per minute
   c. Children, 24 per minute
2. Factors affecting respiratory rate
   a. Fever—increases
   b. Anxiety—increases
   c. Insufficient oxygen—increases
   d. Depressant drugs— decreases
   e. Sleep—decreases
3. Lung capacity—adult male, 6 liters
4. Tidal volume—volume of gas inhaled or exhaled during a single respiratory cycle—500 cc normally
5. Dead space air—air remaining in air passageways, unavailable for gas exchange.—approximately 150 cc
6. Alveolar air—the air reaching the alveoli for gas exchange—approximately 350 cc

INSTRUCTOR'S NOTES

Expirations against partially closed glottis in neonates.

7. Minute volume—the amount of gas moved in and out of the respiratory tract per minute. Determined by:
   a. The tidal volume times
   b. The respiratory rate
8. Vital capacity—forced exhaled volume

H. Factors altering carbon dioxide levels in the blood
   1. Arterial carbon dioxide ($PaCO_2$) represents a balance between CO_2 produced during metabolism and CO_2 eliminated through respiration
   2. Causes of elevated $PaCO_2$
      a. Increased CO_2 production
         i. Fever
         ii. Muscular exertion
         iii. Shivering
         iv. Metabolic processes resulting in formation of acids
      b. Decreased CO_2 elimination (hypoventilation)
         i. Respiratory suppression by drugs
         ii. Airway obstruction
         iii. Mechanical problems
      c. Causes of decreased PCO_2—hyperventilation

I. Factors altering oxygen levels in the blood
   1. Causes of decreased oxygen levels in the blood
      a. Fluid in alveolar interstitial spaces
      b. Alveolar collapse causing atelectasis
         i. I.e., pneumothorax
         ii. Poor coughing
      c. Shunting—blood flow to nonfunctional alveoli
   2. Management
      a. Supplemental oxygen
      b. Intermittent positive pressure ventilation

Pathophysiology

A. Obstruction
   1. Tongue
      a. Occluding posterior pharynx
      b. Most common cause of obstruction
   2. Foreign body
      a. Aspirated while eating
      b. From mouth
         i. Loose teeth
         ii. Child "eating" inanimate object
      c. Trauma
         i. Facial bones
         ii. Teeth
         iii. Nasal bones
         iv. Clotted blood
   3. Laryngeal spasm

INSTRUCTOR'S NOTES

IPPV

a. Cord edema
b. Cord spasm
4. Fractured larynx
a. Nonsupport of cords
b. Collapse into tracheal/laryngeal lumen

B. Aspiration
1. Vomitus
2. Blood
3. Liquid drink

C. Inadequate ventilation
1. Rate
a. Hyperventilation
b. Hypoventilation
2. Depth
a. Shallow
b. Deep
3. Trauma
a. Fail chest
b. Open pneumothorax
c. Other obstructions
4. Disease
a. Chronic obstructive pulmonary disease
b. Asthma
c. Other

Assessment

Visual Techniques

A. Rise and fall of chest
B. Color of skin
C. Flaring of nares
D. Retraction
1: Intracostal
2. Suprasternal notch
3. Supraclavicular fossa
4. Subcostal

Auscultation Techniques

A. Air movement at mouth and nose
B. Bilateral lung field
1. Most accurate method
2. Anterior and lateral chest wall
a. Excellent for pneumothorax
b. Experience necessary to prevent confusion of tracheal sounds from paryenchymal sounds

Palpation Techniques

A. Air movement at mouth and nose
1. Back of hand

INSTRUCTOR'S NOTES

Viral pneumonia

Listen

Feel

TOPIC	CONTENT OUTLINE
	2. Cheek
	B. Chest wall
	1. Direct palpation
	2. Practice required
	C. Bag
	1. Rate of emptying
	2. Compliance of lungs
	3. Air leak
	D. Pulse technique
	1. Tachycardia occurs with hypoxemia
	2. Bradycardia signifies severe anoxia cardiac arrest imminent
History Technique	A. Past medical history
	B. History of present complication
	C. Mechanism of injury
	Management
Manual	A. Chin lift
	1. Thumb on anterior mandible
	2. Index finger on inferior mandible
	3. Anterior traction lift
	B. Jaw lift
	1. Thumb on lower incisor
	2. Index finger on inferior mandible
	3. "Thrust" jaw anteriorly
	C. Jaw thrust
	1. Two hands
	2. Thumbs on zygoma bilaterally
	3. Fingers beneath symphysis of mandible
	4. "Thrust" jaw anteriorly
	D. Head tilt
	1. Head hyperextended backward
	2. Hand on forehead
	3. Hand on cervical neck-left
	4. Should not be done on trauma patient
Mechanical	A. Nasal airway
	1. Description of devices
	a. Length 17–20 cm
	b. Diameter 20–36 french
	c. Gentle curve
	d. Flair at outer end
	2. Advantages
	a. Rapid insertion

INSTRUCTOR'S NOTES

No resistance.

Without changing neutral neck position.

Without changing neutral neck position.

Without changing neutral neck position.

Not on trauma patient

b. Bypasses tongue
c. May be used when gag reflex present

3. Disadvantages
a. Small size
b. May not go behind tongue
c. Difficult to insert if nasal damage present
d. Does not isolate trachea
e. Difficult to suction through

4. Method
a. Insert into naris
b. Convex side caudad
c. Gentle pressure
d. If unable to pass use other naris
e. Do not force

B. Oral airway

1. Description of device
a. Length
b. Shape
i. Hollow oblong cylinder
ii. "H" shape
c. Gentle curve
d. Flair on outside end

2. Advantages
a. Holds tongue forward and down
b. Large suction will pass on either side
c. Effective bite block
i. Convulsions
ii. Protection for ET tube

3. Disadvantages
a. Does not isolate trachea
b. May obstruct airway with tongue if not properly inserted
c. Cannot be inserted when:
i. Gag reflex present
ii. Teeth tightly clenched

4. Size selection
a. Device measurement
i. Corner of mouth
ii. Tip of earlobe

5. Method
a. Straight insertion
i. Convexity caudad
ii. Tongue blade pushes tongue caudad and anterior
iii. Airway slips along tongue into hypopharynx
b. Reverse insertion
i. Convexity cephalod

INSTRUCTOR'S NOTES

Old or new.

ii. Airway inserted gently to soft palate
iii. Airway rotated 180 degrees into hypopharynx

c. Evaluate placement
i. Air movement from mouth
ii. Skin color
iii. Pulse
iv. Auscultation

C. Esophageal intubation device

1. Description of device
a. Approximately 15 inche-flexible tube
b. Mask adaptor at proximal end
c. Closed distal end
d. Detachable face mask
e. Mask has one port
f. Perforations in upper third of tube

2. Necessary equipment
a. 35-cc syringe
b. Lubricant
c. Bag-valve-mask or demand valve
d. Oxygen source with O_2 tubing
e. Suction equipment/device
f. Stethoscope
g. Oral airway

3. Advantages
a. Rapid insertion
b. Prevents regurgitation/aspiration
c. High concentration O_2 delivery
d. Blind insertion
e. Allows endotracheal intubation placement
f. Requires less training than endotracheal intubation
g. Insertion without neck flexion/hyperextension

4. Disadvantages
a. Requires patient to be unresponsive/gag reflex absent
b. Removal when patient becomes responsive
c. Esophageal laceration
d. Tracheal intubation
e. Used for short periods of time
f. Requires tight seal with mask

5. Contraindication
a. Known/suspected esophageal disease
b. Caustic poisoning ingestion
c. Gag reflex present
d. Height under 5.0 feet/over 7.0 feet

6. Insertion method
a. Suction equipment/device available

INSTRUCTOR'S NOTES

5–20 seconds.

2.0 hours.

Esophageal varices, esophageal strictures or diverticuli.

b. Test balloon cuff/inlet port integrity
c. Assemble mask and tube
d. Lubricate tube
e. Maintain patient's head in neutral position
f. Preoxygenate
g. Grasp tongue and lower jaw and pull forward
h. Advance tube into esophagus until mask flush against face
i. Establish mask seal
j. Auscultate lung fields bilaterally with oral ventilation
k. Auscultate over epigastrium
l. Inflate 35 cc cuff if positioned properly
m. Ventilate and check for chest rise
n. Reauscultate lung fields bilaterally/epigastrium
o. Reoxygenate

7. Removal method
a. Not indicated in the field with unconscious patient
b. Have suction available/working
c. Turn patient on side
d. Detach mask from tube
e. Deflate cuff
f. Gently and quickly remove tube
g. Expect regurgitation
h. Suction oropharynx/mouth well
i. Assess respiratory status
j. Oxygenate

D. Esophageal gastric tube
1. Description of device
a. Modification of esophageal obturator
b. Approximately 15 inch flexible tube
c. Mask adaptor at proximal end
d. Mask has two ports
e. Distal end of tube ports has one-way valve
f. Interior accomodates nasogastric tube

2. Necessary equipment
a. Same equipment as esophageal obturator
b. Nasogastric tube

3. Advantages
a. Same as esophageal obturator
b. Permits passage of nasogastric tube
c. Permits gastric decompression

4. Disadvantages
a. Same as for esophageal obturator
b. Requires suction equipment application

5. Contraindications

6. Insertion method

INSTRUCTOR'S NOTES

Chin-lift maneuver. do not force.

15–20 seconds maximum time lapse for insertion between ventilations.

If patient intubated. turning is not necessary.

Ventilation and suction ports.

Further reduces opportunity for regurgitation.

Same as for esophageal obturator device.

a. Same as for esophageal obturator
b. Measure proper length of nasogastric tube
c. Lubricate end of nasogastric tubing
d. Preoxygenate patient
e. Insert to measured length
f. Reoxygenate
g. Apply suction to nasogastric adaptor

7. Removal method
a. Same for esophageal intubation
b. Expect regurgitation/suction
c. Reassess respiratory status
d. Oxygenate

E. Pharyngeal Tracheal Lumen Multiple Balloon System

Ventilation

A. Mouth to mouth
1. Benefits
a. No equipment required
b. Immediate ventilation
2. Limitations
a. Difficult to clear obstruction
b. Disease
c. Training required
3. Method of administration
a. Mouth to mouth
b. Mouth to nose
c. Mouth to stoma

B. Mouth to mask
1. Construction
a. Pocket type flexible mask
b. Oxygen port
2. Benefits
a. Ease of use
b. Rapid oxygenated ventilation
3. Limitations
a. Inadequate seal
b. Training required
4. Method of use
a. Position of patient
b. Open/clear airway
c. Oxygen applied
d. Position mask/seal

C. Bag-valve-mask
1. Construction
a. Bag with one-way valve and mask
b. Oxygen port

INSTRUCTOR'S NOTES

Extend tubing from tip of nose to earlobe to xiphoid, note proper length.

This device has not been adequately researched at the time of this curriculum.

For this section review current AHA-ACLS standards.

2. Benefits
    a. High oxygen concentration delivery
    b. Provides positive pressure ventilation
    c. Assists slow respiratory rates
3. Limitations
    a. Training/skill
    b. Difficult to use
    c. Inadequate seal
4. Method of use
    a. Position patient
    b. Open clear airway
    c. Placement oral pharyngeal airway
    d. Oxygen source attached
    e. Position mask on face
    f. Create seal
    g. Grasp mask between web of thumb and fingers
    h. Fingertips grasp mandible
    i. Deflate bag by manually squeezing

D. Demand valve
1. Benefits
    a. Connects to mask, ET or esophageal intubation device
    b. Provides 100% oxygenation
    c. Can ventilate past minor obstruction
    d. Ease of operation
    e. Slight inspiratory triggering
2. Limitations
    a. Gastric distension
    b. Nonhumidified oxygen
    c. Potential pulmonary rupture
    d. Adult patients only
    e. Dependent on oxygen source
    f. Compliance of lungs not detectable
    g. Effectiveness gauged by chest expansion only
    h. Inspiratory volume control
3. Method of administration
    a. Explain to conscious patient
    b. Appropriate mask size
    c. Position head
    d. Seal mask
    e. Manually/automatic triggering
    f. Assess chest rise
    g. Expiration passive

E. Evaluation of effectiveness
1. Chest movement
2. Auscultation

INSTRUCTOR'S NOTES

a. Left lung field
b. Right lung field
c. Stomach

Suction

A. Airway
B. Physiology
C. Pathophysiology
1. Vomitus
a. Contents
i. Partially digested chunks of food
ii. Protein dissolving enzymes
iii. Hydrochloric acid
b. Results
i. Increased interstitial fluid
ii. Obliteration of alveolae
iii. Marked increased alveolar-opillary distance partial aeroation of segments of extracting 0_2 or off loading $C0_2$
iv. Bronchular obstruction by food particles
v. Several types of respiratory initiators
vi. 50%–80% mortality rate
2. Saliva
a. Contents
i. Digestive enzymes for starches
b. Results
i. Fill alveolus
ii. Reduction of alveoli for ventilation
3. Food
a. Contents
b. Results
4. Blood
a. Contents
i. Protein
ii. Fibrin
iii. Water
iv. Electrolytes
b. Results
i. Clogging of alveoli and bronchi
ii. Chemical reaction to hypertonic fluid
D. Assessment
1. Visualization
2. Auscultation
a. Lungs
b. Trachea
E. Management
1. Whistle tip suction

INSTRUCTOR'S NOTES

Epigastrium

See airway and ventilation

Varies.

Large particles obstruct airways.

Presence of liquid and solid particles in hypopharynx and mouth.

a. Construction
   i. Flexible tube
   ii. Thumb hold
b. Advantages
   i. Small
   ii. Easy to use
c. Disadvantages
   i. Unable to move large volumes of fluid quickly
   ii. Unable to retrieve even small food particles
   iii. Long suction periods will deplete inspired 0_2 available for the lungs
d. Method
   i. Insert into:
      (a) Nasal airway or endotracheal tube
      (b) Close side hole with thumb
      (c) Aspiration for 20 seconds while removing tube slowly
   ii. Insert beside oral airway
      (a) Use above technique

2. Tonsil tip suction
   a. Construction
      i. Rigid
      ii. Large tip
   b. Advantages
      i. Large size
      ii. Can remove food particles that are sucked onto tip
   c. Disadvantages
      i. Size will only fit beside oral airway
      ii. Vigorous insertion can produce lacerations or other injuries to oropharynx
   d. Method
      i. Insert along side of oral airway into mouth and back into hypopharynx
      ii. Slowly remove while suction still activated to remove large particles

Endotracheal Intubation (Optional)

A. Endotracheal intubation (ET)
   1. Device description
      a. Endotracheal tube
         i. Flexible tube
         ii. Balloon cuff on distal end
         iii. 15 mm adaptor on proximal end
         iv. Tube length proportioned to internal diameter
   2. Necessary equipment
      a. Laryngoscope/blade
         i. Used to expose glottis

INSTRUCTOR'S NOTES

Children up to 8 years w/o cuff.

Average adult takes 8 mm ET

ii. Interchangeable handles
iii. Curved blades placed in vallecula
iv. Straight blades placed under epiglottis
v. Light on blade or handle
vi. Traction is extended upward on handle

b. Stylet
i. Flexible/malleable
ii. Types of construction
iii. ET conforms to desirable configuration
iv. Tip recessed at least 2 cm from tip of ET
v. Right angle hook over adaptor end
vi. Lubricate to assure removal

c. Magell forceps
i. Scissor style clamp
ii. Circle-shaped tips

d. Suction
i. Flow rate
ii. Mechanism of creating suction
iii. Types

e. Bag-Valve device
i. Attachment to ET tube adaptor
ii. Accumulator
iii. Methods of squeezing bag
iv. Construction and cleaning of valve

f. Mask
i. Construction
ii. Face mask seal
iii. Connection to valve

g. Lubricant
h. Stethoscope
i. Oral airway
j. Syringe
k. Oxygen source/tubing

3. Advantages
a. Complete control of airway
b. Prevents aspiration
c. Intermittent positive pressure
d. Tracheal suctioning
e. Prevents gastric distention
f. High volume ventilation
g. Medication administration
h. Placement around esophageal intubation devices

4. Disadvantages
a. Requires training/ experience
b. Requires direct visualization

INSTRUCTOR'S NOTES

Hockey stick

Removed foreign bodies

Patient must be adequately hyperventilated prior to intubation attempt.

Used as bite block

c. Requires equipment
d. Tissue damage
e. Esophageal intubation
f. Laryngospasm upon attempt
g. Intubation of pyriform sinus
h. Foreign body
i. Delays in oxygenation prior to success

5. Contraindications
   a. Trauma: hyperextension of flexion required
   b. Prolonged attempt increases hypoxemia
6. Method of insertion
   a. Establish ventilation
      i. Mouth to mask
      ii. Bag-valve-mask
      iii. FiO_2 0.90–1.0
      iv. Assure adequate ventilation
         (a) Chest rise
         (b) Auscultation lungs
         (c) Auscultation stomach
         (d) Color
   b. Estimate correct ET size
      i. Adult
      ii. Pediatric
   c. Check balloon
      i. Inflation
      ii. Leaks
      iii. Inlet port integrity
   d. Hyperventilate patient with bag-valve-mask (BVM)
   e. Position head and neck
      i. Nontrauma
         (a) "Sniffing" position
         (b) Flex at C5 C6
         (c) Extend at C1 C2
      ii. Trauma
         (a) In-line stabilization by partner
         (b) Maintain neutral position
         (c) Mandible and tongue only move during intubation
         (d) Patient frequently flat on ground or asphalt
         (e) Proper body position of the EMT-P to see cords with patient on the ground
   f. Remove BVM
   g. Insert laryngoscope, right side of mouth, tongue to the left
   h. Visualize epiglottis, larynx, and vocal cords
      i. Lift tongue and mandible with scope
      ii. Do not rotate scope

INSTRUCTOR'S NOTES

Vocal cords, trachea, teeth, clips, pharynx.

Foreign body must be removed.

Neutral positioning AHA-ACLS 15–20 second for attempt.

90–100% oxygen.

5–10 seconds hyperventilation

Prone or straddling patient's head.

iii. Do not touch teeth with scope
iv. Pressure on larynx sometimes helpful

i. Insert ET tube between cords. visualize passage
j. Remove laryngoscope
k. Connect bag valve to ET adaptor
l. Ventilate lungs
   i. Assure chest rise
   ii. Auscultate lungs
   iii. Auscultate stomach
m. Inflate cuff
n. Secure tube to head and face
o. Reassess lungs sounds/epigastrium
p. Continue ventilation
q. Return to BVM. ventilation when
   i. ET tube in esophagus
   ii. No breath sounds in lungs
   iii. Air into stomach
   iv. Unable to get ET tube in place
r. Suction may be necessary
s. Breath sounds on right only
   i. Auscultate
   ii. Withdraw tube slowly until breath sounds heard on laryngoscope
t. Removal
   i. Spontaneous respirations
   ii. Patient's intolerance of tube
   iii. Gag reflex present
   iv. Suction available
   v. Deflate cuff completely
   vi. Withdraw on inspiration
   vii. Suction airway
   viii. Assess respiratory status
   ix. Oxygenate patient

INSTRUCTOR'S NOTES

Upper incisor.

Stylette may be necessary for insertion of ET.

AHA-ACLS 15–20 seconds placement time.

Not indicated in field unless